Appendicitis in Mature Patients

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All patients greater than 50 years of age (N = 96) admitted with a pre- or postoperative diagnosis of acute appendicitis from 1971 to 1980 were reviewed. A comparative series of 91 patients aged 25 to 50 years was similarly reviewed. Noninflammatory diseases of the appendix and incidental appendectomies were excluded. Detailed study of symptoms, clinical presentation, laboratory evaluation, radiographic evaluation, concomitant diseases, hospital course, surgical findings, complications, and mortality were completed. Comparison of patients aged 25 to 50 to patients older than 50 years revealed a statistically significant increased incidence of perforation in the older group ($p < 0.0001$). Sixty-five per cent of the older group showed greater incidence of perforation. Further analysis of this series yields the hypothesis that the increased incidence of perforation is related to a significant decrease in the frequency of classic presentation in the greater-than-50 age group, a significant decrease in frequency of correct admission diagnosis and a significant delay between admission and surgical procedure in the older group. A more rapid pathophysiologic progression of appendicitis with increasing age was noted. A much higher percentage of older patients was undiagnosed until the surgical procedure. In this group, there was a longer duration of symptoms, less frequent classic presentation, and decreased frequency of right lower quadrant guarding and tenderness as compared to patients with correct diagnosis prior to surgery. Complications were much more frequent in older patients and higher still in those with perforation. Analysis of findings by decade of life revealed an anticipated high incidence of perforated appendicitis in patients greater than 50, but also showed a continuation of the high incidence of perforation into the decade 40 to 50. There were three deaths in the entire study group (1.6%) all occurring in the older age group with postoperative sepsis.

APPENDICITIS CONTINUES to represent a diagnostic and therapeutic challenge to physicians and especially surgeons.[1] Virtually all medical professionals maintain a healthy respect for the potential morbidity and mortality from this disease and realize that recent spectacular technical advances in the diagnosis and treatment of other disease states have been less applicable to the expedient treatment of appendicitis.[2-4]

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It is reported that every 15th human (seven per cent) will suffer from acute appendicitis in his lifetime.[5] Reported series indicate the peak incidence of appendicitis occurs in th 15- to 24-year age group[6] and, in this setting, more frequently appears in the classic form.[2] After the age of 50, the risk of appendicitis decreases to one in 35 for women and one in 50 for men,[5] but many series indicate that patients older than 50 years are the group in which the majority of morbidity and mortality from appendicitis occurs.[7-17] The advancing average age of the world's population serves to promote continued interest in the study of appendicitis and in efforts to reduce the ravages of this disease.

While acknowledging that chronic or concomitant disease states weaken the overall resistance of patients in the older age group, infection is by far the most frequently referenced etiologic factor in the increased morbidity and mortality of appendicitis in older patients.[2,5,7-17] Further study reveals that the rate of infectious complications after surgery is dramatically increased in patients with appendiceal perforation at the time of surgical treatment. Multiple reports indicate a perforation rate of 32 to 70% in patients older than 50 years of age[2,5,7-17] and frequent reference is made to the difference in pathophysiological evolution as well as delayed diagnosis and treatment as primary factors in the high rate of perforation and subsequent complications.[2,5,8,18]

This study was undertaken to evaluate the current status of appendicitis in adult patients in our institution with specific interest in patients older than 50 years of age.

Methods

This retrospective study was completed at the Erlanger Medical Center Hospital, a University of Tennessee College of Medicine-affiliated institution in Chattanooga, Tennessee. Records of all patients older than 50 years of age with a diagnosis, either before or after surgery, of

TABLE 1. *Patient Distribution*

Older than 50 years*		Between 25 and 50 years†	
50 to 60	46	25 to 30	39
60 to 70	32	30 to 40	38
70 to 80	16	40 to 50	26
Older than 80	11	Total patients	103
Total patients	105	False-positive diagnoses	12
False-positive diagnoses	9	Confirmed diagnoses	91
Confirmed diagnoses	96		

* There were 50 men and 46 women.
† There were 58 men and 33 women.

acute appendicitis from January 1971 to December 1980 were reviewed. One-hundred-five cases were identified in this patient population. For comparative purposes, a second series of 103 consecutive patients ages 25 to 50 were also reviewed during a comparable period. All incidental appendectomies and cases with pathological reports of chronic appendicitis were excluded. Only patients with pathologic confirmation of acute appendicitis were included in the study. Records were analyzed for pertinent history and physical, operative, and clinical course findings throughout the hospital stay of these patients. These factors were then analyzed in a comparison of the patients older than 50 years old with those patients aged 25 to 50. Each group was further subdivided and evaluated based on whether or not perforation was present.

Results

Patient Distribution

The distribution of studied patients with confirmed acute appendicitis is displayed in Table 1. There were nine patients (8.5%) in the over-50-year-old group with a false-positive diagnosis. These patients were excluded from statistical analysis, leaving 96 study patients: 50 men and 46 women. In the comparison group, there were 12 patients (12.5%) with a false-positive preoperative diagnosis, leaving 91 study patients: 58 men and 33 women.

Patient History

Table 2 reflects pertinent information gathered from the recorded history at the time of admission. Further analysis of patients, depending on the presence or absence of perforation at the time of surgery, is also displayed.

The "classic presentation" of initial onset of vague midline pain with late localization to the right lower quadrant and subsequent onset of nausea, vomiting and anorexia was noted less often in the older patient group ($p < 0.001$). Pain in the right lower quadrant was a frequently mentioned complaint in both groups but less frequent in the older group ($p < 0.03$). Patients in both groups frequently perceived the initial localization of pain during this illness to occur in the midabdomen or diffusely in the abdomen. This was more often the case in the older patients ($p = 0.001$). However, a significant number of the younger patients reported initial pain to occurring in the right lower quadrant ($p = 0.001$) and never noted pain in any other location. Study of these factors suggests that a significant number of the older patients developed diffuse abdominal pain, but never perceived localization of pain in the right lower quadrant.

Analysis of duration of pain prior to admission reveals that a significantly lower percentage of total patients in

TABLE 2. *Admission History*

	Older than 50 years			Between 25 and 50 years		
Information	Total N = 96 %	Nonperforating N = 34 %	Perforating N = 62 %	Total N = 91 %	Nonperforating N = 68 %	Perforating N = 23 %
"Classic" prodrome	25	32	23	49	51	43
Right lower quadrant pain	63	74	56	77	75	87
Initial pain location						
Midabdomen or diffuse	94	92	93	76	80	61
Right lower quadrant	6	8	7	24	20	39
Onset pain prior to admission						
<24 hours	42	56	34	64	74	35
24–48 hours	29	26	31	17	14	26
48–72 hours	5	0	8	9	6	9
>72 hours	24	18	25	10	6	30
Nausea	66	59	69	78	78	83
Vomiting	54	47	58	54	50	65
Anorexia	20	9	26	37	34	49
Fever	14	6	18	11	9	17
Chills	9	3	13	5	6	4
Diarrhea	8	3	11	10	9	13
Constipation	8	2	6	3	3	4
Prior physician care	17	15	18	9	9	4
Concomitant disease	38	21	47	18	13	30

TABLE 3. *Physical and Laboratory Findings*

Information	Older than 50 years			Between 25 and 50 years		
	Total N = 96 %	Nonperforated N = 34 %	Perforated N = 62 %	Total N = 91 %	Nonperforated N = 68 %	Perforated N = 23 %
Pulse	43	38	45	30	19	61
Temperature >100 F	60	53	65	41	32	70
Right lower quadrant tenderness	96	100	94	98	97	100
Diffuse tenderness	16	3	23	5	7	0
Guarding	51	65	55	63	69	43
Rebound tenderness	56	59	55	58	56	65
Referred rebound	32	38	27	31	31	30
Hypoactive bowel sounds	67	71	65	72	72	65
Abdominal distention	25	9	34	7	4	13
Rectal tenderness	24	32	19	25	29	39
Psoas sign (+)	4	12	0	10	8	22
Palpable mass	16	9	19	8	3	22
Abdominal x-rays with positive findings	40	35	44	20	14	39
Complete blood count suggests diagnoses	80	91	74	81	78	91

the older group came to the hospital within 24 hours of pain onset than did the younger. While both groups showed large numbers of patients with perforation, even if admitted within 24 hours of onset, there was a significant increase in perforation rate in the older group when compared with the younger ($p = 0.0002$). Admission was also delayed longer than 72 hours in a greater number of older patients ($p < 0.02$), but there is no statistical difference in perforation rates between the two age groups if admission is delayed this long. If all ages are combined and patients admitted within 24 hours of pain onset are compared to those admitted with greater than 72-hour history, there is a significant increase in the rate of perforation ($p = 0.0002$). It is interesting to note that of those patients with perforation, 34% and 35%, had a history of pain less than 24 hours. This attests to an aggressive pathologic process. An interesting group of older patients without perforation at surgery had a history of pain greater than 72 hours prior to admission.

Complaints of nausea and vomiting were mentioned relatively frequently in both groups. Anorexia was a less prominent symptom in either group, but was even less common in older patients ($p = 0.008$). If anorexia was present in the older group, there was a greater chance of perforation present at that time ($p = 0.04$). Fever, chills, diarrhea, and constipation were infrequently mentioned symptoms.

Seventeen per cent of older patients and nine per cent of younger patients were seen by a physician at least once prior to hospitalization without establishment of the correct diagnosis. As expected, concomitant diseases (diabetes, ASHD, COPD, CHF, hypertension, obesity, and liver disease) were more commonly encountered in the older group than the younger group, but were noted relatively more frequently in patients with perforation in both study groups.

Physical Examination

Table 3 records pertinent physical findings at the time of admission. A pulse rate greater than 90 and a temperature greater than 100 were noted in a number of patients in both groups, with both findings more frequently encountered in patients with proven perforation. Right lower quadrant tenderness was noted in greater than 95% of all patients and was the most significantly encountered physical finding without significant difference between age groups. Diffuse abdominal tenderness was noted more frequently in older patients ($p < 0.03$), especially among those with perforation. Guarding and rebound tenderness in the right lower quadrant area were noted in greater than 50% of both patient groups. Referred rebound tenderness was present in a number of individuals in both groups, and may have been a factor in the choice of incision at operation. Absent or hypoactive bowel sounds were noted in greater than 65% of all patients without significant differences. Abdominal distention was noted more frequently in the older patient group ($p = 0.001$) and especially among those with perforation. Rectal tenderness was noted almost equally. A positive psoas sign was noted infrequently in older patients and identified more often in younger patients with perforation increasing the frequency of positive response. A palpable abdominal mass occurred more frequently in both groups with perforation, and since perforation was present more frequently in older patients, was represented more frequently in the older patients.

TABLE 4. *Clinical Course*

Information	Older than 50			Between 25 and 50 years		
	Total N = 96 %	Nonperforating N = 34 %	Perforating N = 62 %	Total N = 91 %	Nonperforating N = 68 %	Perforating N = 23 %
Time diagnosis established						
Admission	67	88	55	85	88	76
Preoperative before surgery	10	3	15	12	9	23
Postoperative after surgery	23	9	30	3	4	0
Admission to surgery interval						
<12 hours	78	92	71	92	92	91
12 to 24 hours	7	0	10	3	4	0
>24 hours	15	8	19	5	4	9
Incision choice						
Right lower quadrant	49	70	41	81	84	74
Right paramedian	26	15	32	7	7	4
Midline	25	15	27	12	9	22
Complications	60	47	67	14	7	33
Mortality	3	3	3	0	0	0
Hospital stay						
<5 days	15	29	6	54	68	13
6–10 days	35	44	31	35	28	57
11–15 days	29	18	35	11	4	30
>16 days	21	9	27	0	0	0

Laboratory and Roentgenogram

Table 3 also outlines significant roentgenogram and laboratory findings. Paralytic ileus was noted on abdominal radiographs in 40% of older patients and 20% of the younger patients with higher frequency noted in those patients with perforation. Several were noted to have radiological evidence of small bowel obstruction, which probably had a major impact on the decision to operate and on the choice of incision. Barium enema evaluation was performed on 15 patients at a time when the diagnosis was in doubt and identified positive findings compatible with appendicitis in eight cases. White blood counts were suggestive of an inflammatory process in over 80% of total patients when the criteria of white blood count greater than 10,000 or neutrophil count of greater than 75% of differential was used. There was a slightly lower percentage of elevated white blood cells in older patients with perforation. Routine cultures collected at the time of surgery showed a more frequent growth of coliform organisms, especially *Escherichia coli*. Bacteroides and occasionally other anaerobes were infrequently cultured, except in those patients with perforation and abscess formation.

Clinical Course

Table 4 summarizes the clinical course of patients included in this series. The overall accuracy of admission diagnosis was significantly lower in older patients ($p < 0.005$). Eighty-eight per cent of both groups without perforation had an accurate diagnosis made at admission evaluation. Further analysis of total patient groups shows that an additional 10% of older patients and 12% of younger patients had the diagnosis made or suspected during an observation period after admission, and findings during this time changed enough to promote surgical exploration. This period of delay in diagnostic decision resulted in a higher ratio of perforation in both groups. As expected, there was a less accurate admission diagnosis established in those patients with perforation in both groups. An especially large number of patients in the older group did not have the diagnosis made until surgical exploration was performed (22 patients: 23%). In the older patients not diagnosed until surgery, there was a much more frequent incidence of perforation (19 patients). The incidence of perforation in older patients was 65%; in the younger patients, 25%.

Seventy-eight per cent of older patients and 92% of younger patients underwent operative therapy within 12 hours of admission with the difference probably a reflection of the higher frequency and accuracy of early diagnosis in the younger patients. This seems supported by the fact that a higher percentage of patients without perforation in both groups (92%) underwent early surgery. Difficulty establishing a firm diagnosis occurred in patients with perforation and apparently led to less aggressive early sugical intervention. There was a significantly higher rate of perforation in the older group of patients when the delay from admission to surgery climbed from greater than 12 hours ($p < 0.02$) and to greater than 24 hours ($p < 0.003$).

A variety of incisions were utilized for surgical exploration, with the most common choice being a right-lower-quadrant, muscle-splitting incision. When the total

patient population was examined, this incision was utilized in 49% of the older patients and 81% of the younger patients. However, a right-lower-quadrant incision was utilized more confidently in patients without perforation (70% and 84%). Right-paramedian and midline incisions were utilized more frequently than expected and probably is a reflection of diagnostic uncertainty. The frequency with which the latter incisions were used was much higher in patients with perforation and/or delayed or inaccurate diagnosis. The incidence of wound infection was 25% in older patients, and 6.5% in younger patients. These infections occurred more frequently in patients with perforation and in patients with right paramedian or midline incision. There were three cases of wound dehiscence; one with a midline incision and two with paramedian incisions.

Complications after surgery occurred much more frequently in the older patient group and were much higher in both groups of patients who sustained appendiceal perforation. Three patients in the study died; all were 70 to 80 years old. Pulmonary embolus, acute renal failure, acute congestive heart failure, and delay of surgery for more than 48 hours were etiologic in the three deaths with two having perforation at surgery and one having no perforation. The hospital stay after surgery was significantly longer in the older patient group and longer still in patients with perforation, regardless of age group.

Postoperative Complications

Table 5 details complications from both patient groups. There were 92 complications in 58 individual patients in the greater than 50-year-old group, with the greatest number coming from the perforated group. The most frequent complications encountered arose as a result of surgical infection (wound infection, abscess, and intra-abdominal sepsis). Other frequently encountered problems related to renal function and cardiopulmonary status. Complications were less common in the younger patient group and none led to severe morbidity, but they did cause significantly longer hospitalization.

With the exception of three cases of superficial wound infection, there were no significant complications in the 21 patients with false-positive diagnosis who were excluded from the previously outlined analysis.

Analysis by Decade

After completion of the previously outlined analysis, the factors identified as most significant in establishing an accurate diagnosis and effective treatment course were tabulated for all patients from each decade of life as listed in Table 6. The most significant variation from the expected result was the relatively high incidence of perforation in patients aged 40 to 50 years as compared to more youthful patients, aged 25 to 40 years.

TABLE 5. *Complications*

Complication	Older than 50 years	Younger than 50 years
Surgical infection		
Wound infection	24	6
Postoperative abscess	6	1
Sepsis, general	5	—
Wound dehiscence	2	—
Pulmonary		
Atelectasis	8	3
Pneumonia	3	—
Acute respiratory distress syndrome	2	—
Pulmonary embolus	2	—
Cardiovascular		
Dysrhythmia	7	1
Congestive heart failure	4	—
Metabolic/Other		
Pre-renal insufficiency	13	1
Hypokalemia	10	—
Prolonged ileus	6	1
Total	92*	13†

* In 58 patients.
† In 13 patients.

If patients in the series were then grouped for statistical analysis comparing patients 40–80 years old to those 25 to 40 years old, we found a highly significant difference ($p > 0.001$) in the increased incidence of perforation in the former group. Further analysis of factors indicates that statistically significant increased incidence of perforation occurs as a result of a decrease in the frequency of classic symptoms at the time of admission ($p = 0.003$), a subsequent significant reduction in correct admission diagnosis ($p = 0.035$), and a significant delay of greater than 12 hours between admission and surgical treatment in this patient group ($p = 0.04$). Similar statistical differences exist when the groups greater than 50 years old and 25 to 50 years old are compared. There was consistent failure of statistical differences when right lower quadrant tenderness and diagnostic CBC were evaluated. This attests to the accuracy of these tests in diagnosis of appendicitis, regardless of age.

Discussion

Our study confirms that appendicitis is a significant problem in the adult population with worsening incidence of complications and mortality in the extremes of life. This finding has been reported by numerous authors who have similarly documented that mortality and morbidity is largely a function of infectious complications as a result of perforation of the appendix at the time of surgery.[2,5,8–14] The common denominator in lowering the mortality and morbidity is a combination

TABLE 6. *Patient Profile by Decade*

	25 to 30 N = 34 %	30 to 40 N = 33 %	40 to 50 N = 24 %	50 to 60 N = 42 %	60 to 70 N = 29 %	70 to 80 N = 15 %	Older than 80 N = 10 %
Perforation	15	24	42	52	66	73	100
Presentation greater than 24 hours	76	58	54	36	45	47	50
Classic prodrome	59	45	42	29	34	13	10
Right lower quadrant tenderness	97	97	100	100	97	93	70
Diagnosis by complete blood count	82	76	88	81	79	87	70
Correct diagnosis on admission	79	88	83	76	69	53	40
Interval less than 12 hours to surgery	88	94	96	79	83	60	70
Hospital stay longer than 5 days	44	36	63	83	83	93	90

of reduction in the rate of perforation at the time of surgery and aggressive management of infectious sequelae during and after surgery where perforation has already occurred. Failure to proceed to early diagnosis and surgical treatment at any age leads to increased mortality and morbidity. This is particularly manifested in the older population group.[5,7-17,19]

Delayed treatment as a result of the patients failure to seek treatment is beyond the control of physicians, and will likely improve only through patient education leading to heightened awareness and suspicion.[7,12,15,19] The responsibility for failure to achieve early diagnosis and effective surgical treatment of patients after they have seen a physician is the responsibility of the physician and can best be improved through similar efforts at improved awareness.[10,15,17,19] It is notable that, in our study, 17% of older patients had been seen by a physician early in the disease without accurate diagnosis being made. Others have noted similar findings.[15,17]

The incidence of perforation in this study was 65% for patients older than 50 years old, 25% for patients 25 to 50 years old, and 40% for the entire series. This parallels the experience of other authors.[2,11,15] The exact cause of this higher rate of perforation in older patients, other than delayed presentation and diagnosis, appears to be related to acceleration of the normal pathophysiological process of appendicitis as patients age. Other authors have suggested that the accelerated disease process in older patients is related to decreased lymphoid tissue, decreased appendiceal blood supply, thin mucosa, obliterated lumen, fibrosis in the wall with fatty infiltration, arteriosclerosis of the small vessels, and phlebosclerosis of the small vessels in the appendix.[5,8,10,18] Whether any single factor or combination of factors is principally responsible for an accelerated form of disease is not clear. Our study documents a rapid progressing disease state in both younger mature patients and older patients with 34% and 35% of the patients with perforation having a history of less than 24 hours duration. At what stage the physiologic or anatomic factors that lead to an accelerated disease process and more rapid perforation occur is unclear. Our study, like that of Scher and Coil[15] and Koepsell, et al.,[18] documents a sharp rise in the incidence of perforation in the 40- to 50-year-old decade. This suggests that the pathophysiologic changes which predispose the patient to early perforation occur earlier in life than we had previously suspected. The progressive increase in perforation rate during succeeding decades beyond age 40 has been noted in this study and in the studies of others.[7,15,18]

Careful analysis of symptoms and signs in patients with appendicitis indicates increasing difficulty in diagnosis and confusion with other disease states as patients grow older. The increased presence of chronic diseases, such as arthritis, diverticulosis, chronic constipation, hypertension, congestive heart failure and diabetes, probably leads to confusion or distraction in early, complete evaluation with resultant delayed diagnosis and treatment. Perhaps patients are less mindful of the onset of the relatively vague early symptoms of appendicitis as a result of these chronic coexisting problems.

It is interesting to note that older patients related an initial onset of pain to a diffuse location in the abdomen and often did not perceive localization to the right lower quadrant. Patients less than 50 years old more frequently complained of the "classic prodrome" of diffuse pain followed by localization to the right lower quadrant with subsequent onset of nausea, vomiting, and anorexia. These findings have also been confirmed by other authors.[5,14] Another difference regarding pain onset in patient history was that 24% of patients less than 50 years old noted the initial location of abdominal pain

in the right lower quadrant area without recognizing antecedent midline or diffuse pain.

Nausea and vomiting is a relatively frequent symptom in appendicitis.[5,8,16] Anorexia, while reasonably frequent in younger patients, did not prove to be a common complaint in older patients and must be considered less significant. Older patients with anorexia were more frequently found to have perforation. This finding is at variance with Berry and Malt,[2] who felt that anorexia is a highly significant point in establishing the early diagnosis of appendicitis.

This study confirms the findings of others: the most significant early physical sign leading to accurate diagnosis and treatment of appendicitis is the presence of right lower quadrant tenderness.[2,5–9,12,14,16] These findings were noted with essentially equal incidence regardless of patient age and, if present, should suggest a diagnosis of appendicitis until proven otherwise. More patients in both groups were detected to have right lower quadrant tenderness on physical exam, although a smaller percentage gave pain in this location as a historical complaint. This finding was particularly noted in older patients and suggests that surgeons should rely much more on physical findings than history in establishing the diagnosis.

Findings of rebound tenderness and, especially, referred rebound tenderness appeared to cause confusion in the diagnosis and particularly led to problems in the timing of operative procedure and in the selection of incision. Diverticulitis and pelvic inflammatory disease were frequently confused diagnostic considerations when these findings were present. These findings reflect the results of others.[9]

Fever and tachycardia were noted more frequently in the more advanced stages of appendicitis and, while helpful, were not reliable in early or nonperforated cases. Physical findings such as psoas sign, rectal tenderness, presence/absence of bowel sounds, and palpable mass not only did not prove helpful in establishing an early diagnosis in our patients but more frequently reflected late stage disease.

The presence of leukocytosis and/or differential shift to more immature forms was a significant positive finding in all age groups, with no difference in younger patients and older patients. This, too, has been confirmed by other investigators.[2,5,7–9] Plain abdominal films may support the presence of acute intra-abdominal conditions when there is evidence of paralytic ileus or small bowel obstruction, but a normal film should definitely not be utilized to negate the diagnosis of appendicitis.[2] Evidence of small bowel obstruction in a patient with findings and history remotely consistent with appendicitis should encourage earlier surgical intervention with a strong clinical suspicion that perforation has occurred. Fifty per cent of the patients in our study who were subjected to barium enema when the diagnosis was still in doubt showed evidence strongly suggestive of acute appendicitis. These data indicate that this test might be used more widely at an earlier stage in patients where history, physical findings, and laboratory findings are either unclear, unobtainable, or questionable. Controvesy continues over the use of barium contrast studies in the diagnosis of appendicitis,[2,20–22] and further reports will be interesting to follow.

The reduced frequency of complications in appendectomy through a right lower quadrant, muscle-splitting incision serves to underline it as the choice for removal of the appendix.[8,10,11] Increased awareness of appendicitis as a difficult diagnosis and a possible disease entity in patients undergoing exploratory abdominal surgery should suggest a right lower quadrant, muscle-splitting incision for initial exploration in the patient where appendicitis is a possibility. In such cases, we advocate a muscle-splitting incision. Either transverse extension or a second cut, such as a midline incision, can be used for exploration if other diseases are found, or if additional exposure is needed for abscess debridement or drainage. It is our belief that there are significantly fewer complications from surgical infections, atelectasis, incisional hernia, and dehiscence in patients with a right lower quadrant incision as compared to other choices.

Our results underline previous recommendations that early aggressive therapy is just as necessary in older patients as in younger ones.[5,12–14,18] The low incidence of complications from appendectomy where acute appendicitis was not found supports the concept of early, aggressive treatment, while recognizing that a small percentage of patients will fail to have evidence of acute appendicitis. In fact, one could suggest that a more aggressive approach should be used in older patients because of the expectation of a more rapid pathologic evolution of the disease. The permissible or recommended frequency of false-positive nonsurgical diagnoses of appendicitis continues to be scrutinized.[2–4,19] Berry and Malt's[2] interesting and comprehensive report raises the point that reported series with higher rates of preoperative diagnostic accuracy are also those with some of the higher incidences of perforation. The converse is also true. The false-positive diagnostic rate in our series was lower than anticipated in all age groups. Based on the lack of significant complications in those patients with a false-positive diagnosis and the 65% perforation rate in older patients, we feel an even earlier and more aggressive surgical approach is warranted. Perhaps this situation should be approached with the same heightened sensitivity to aggressive diagnosis and earlier operative treatment in pregnant patients where appendicitis is suspected.[23]

This study confirms that the single most important factor in morbidity and mortality in patients with acute appendicitis is the presence of perforation at the time of operation. Infectious sequelae were the most significant and frequent problems encountered and occurred much more often in patients who sustained perforation. This finding was true in patients in all age groups, but to a greater extent in older patients. We, and others,[2,5,8,16,18] have documented that perforation is likely to occur early in adult patients and is a factor not under the control of surgeons. With this in mind, treatment of patients with perforation present should be directed at limiting mortality and morbidity by aggressive management of areas such as effective drainage, careful wound management, antibiotic treatment, careful attention to culture results, and aggressive medical and metabolic support. The issue of whether drainage should be utilized is also surrounded in controversy.[2,8,10,24,25] We favor drainage when abscess or significant contamination has occurred and prefer drainage through the muscle-splitting incision. When drainage was initiated in our patients, Penrose gravity drainage techniques were used. More recently we have begun using closed suction drainage in such cases, with the hope that there will be more effective removal of purulent fluid and less morbidity from the drain itself. Like Coller and Valk,[26] we favor leaving the skin and subcutaneous tissue open, with closure secondary, in most patients where appendicitis is suspected from gross pathologic study and especially if there is total inflammation or any question of perforation. Since the frequency of perforation is so high in patients beyond age 50, following this recommended approach indicates most patients in this group would be left open at the time of surgery.

The use of antibiotics in appendicitis appears warranted and was used prior to surgery in most of our patients. The report of Winslow et al.[27] indicates that antibiotic use reduced the incidence of infectious complications in nonperforating appendicitis and was cost effective. We would agree with Lau et al.[28] that all patients with perforation should receive a full course of antibiotic coverage and recommend initiation of broad spectrum antibiotics in any patient suspected at high risk for sepsis. They consider age greater than 50 years a predisposing factor to postoperative sepsis, and we concur.

Other complications (renal failure, cardiovascular instability, pulmonary insufficiency, and electrolyte disturbances) are related to a combination of pre-existing chronic disease states, advanced sepsis at the time of initiation of treatment, or failure of adequate general supportive measures. Diligent and meticulous attention to details of metabolic and medical support should help reduce morbidity and subsequently provide more cost-effective care through decreased hospital stay.[2,5,8,16]

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